

PH.D. IN PHYSICS

Program Overview

All graduate students in physics must plan their entire program with the advice and approval of a departmental advisor.

The program of graduate studies in physics emphasizes research work, but also includes teaching experience as an essential element. Research and thesis opportunities are at present available in the fields of astrophysics and cosmology, atmospheric, ocean and quantum optics, biological physics, complexity, condensed matter/energy materials physics, elementary particle theory.

Admission Requirements

Consideration is given to applicants who have a B.S. degree in physics (or related field) with a minimum undergraduate GPA of B. Submission of Graduate Record Examination (general and subject GRE) scores is recommended, but not required, with the application for admission. Applicants from non-English-speaking countries must demonstrate proficiency in English via the TOEFL or IELTS test, even if they have previously taken courses in the US. The minimum TOEFL score for admission is 80 in the internet-based test, or equivalent (550 in the paper-based test and 213 in the computer-based one). The minimum IELTS score is 6.5.

Application deadline for the Fall Semester is February 1st. Application for financial aid is automatic and does not require any additional document on the part of the applicant. The only accepted form of application is online through the Graduate School web page (<https://www.grad.miami.edu/apply/on-campus-graduate-programs/>). In addition to excellence in the academic background, consideration for admission is also based on diversity and interest in one of the research fields of the Department. While not bound to it, please indicate in your application your field of interest and whether you are interested in experimental or theoretical work.

We usually do not offer Spring admission and all applications will be considered for fall admission, regardless of the time of submission. In rare circumstances, an exception can be made, and the applicant should contact us at the address reported below to request it before applying.

Curriculum Requirements

In addition to the general requirements for graduate degrees, the Physics Department makes the following specific requirements.

1. A minimum of 24 physics course credit hours at the 600-700 level are required for the PhD.
2. All incoming students, are required to take the following core courses within the first two years:
 - PHY 621 Thermodynamics and kinetic theory
 - PHY 640 Classical Mechanics II
 - PHY 650 Intermediate electricity and magnetism I
 - PHY 651 Intermediate electricity and magnetism II
 - PHY 660 Quantum Mechanics and Modern Physics I
 - PHY 661 Quantum Mechanics and Modern Physics II

The Graduate Director, in consultation with the graduate faculty, may exempt, by examination, students that have taken equivalent courses at previous institution. The core courses will serve as the first part of the comprehensive qualifying exam.

3. Upon completion of the required coursework, the Physics graduate faculty will holistically evaluate the student's progress, taking into account their performance in courses and research, and decide whether the student is allowed to continue to the PhD program.
4. Students are required to participate in research at the earliest opportunity. Mechanisms for doing so include enrolling during the regular semester in a research course (PHY 780) and engaging in research during the summer months; both require the consent of a faculty member supervisor.
5. By the end of the second year, it is the student's responsibility, in consultation with their research mentor and the graduate program advisor, to establish a **Supervisory Committee** consisting of the mentor and at least two other physics faculty. With the addition of a committee member from outside the physics department, the **Committee** may constitute the student's **Ph.D Dissertation Committee**.
6. By the end of the 4th semester a student is also required to complete the second part of the **comprehensive qualifying examination** consisting of a written part in the form of an **Expository Paper** and an oral part in the form of an **Oral Presentation**. In order to complete these parts, a student must be engaged in research with a faculty member. *The paper/presentation need not constitute a proposal for Ph.D dissertation research or include preliminary work toward the dissertation.* Students are expected to consult with and receive approval from their research mentor as to a suitable topic. **The expository paper consists of a paper 5-10pp, 11pt or 12pt typeface.** The paper should include a substantive literature survey (with referencing in standard publication format) that places the topic in context, provides relevant equations, and outlines calculations or experimental design/results as appropriate. Figures (if any) should be incorporated into the text using, e.g., LaTeX or MS Word. Students (and mentors) should be wary to allow sufficient time to research, write, and edit their papers to meet the standards of a scientific publication. The paper must be submitted to the student's supervisory Committee and Graduate Director.

The oral presentation is typically a PowerPoint-type presentation 30-40 min long (not including questions) summarizing the topic of the written qualifying exam. The presentation should include technical detail as necessary to outline the topic and should be at the level of a departmental colloquium, accessible to a general audience of advanced undergraduate and graduate students. The oral presentation cannot be given earlier than 10 days after the submission of the expository paper to allow time for review of the paper.

7. Upon completion of the qualifying examination process, the student's Supervisory Committee, with the Graduate Director, decides if they passed or failed the examination and whether they should be considered as candidate for Doctoral Dissertation.

8. The following additional courses, or their equivalent, are also required for the PhD degree:

- PHY 723 Statistical Mechanics I
- PHY 752 Electromagnetic Theory I
- PHY 770 Quantum Theory I
- Select four additional physics courses at the 600 or 700 level (at least 1 course at the 700 level)

9. With permission from the Graduate Director, students can take courses outside the Department. Courses taken outside the department should be relevant to the students' program and approved by the graduate advisor.

10. Student's progress toward graduation and continuation with the program will be evaluated yearly by the physics graduate faculty. In addition to the Comprehensive Qualifying Examination, during the third year, students are required to make an oral presentation of approximately 30-minutes in front of their Thesis Committee, while during the fourth year, students are required to make an oral presentation to the whole Department as part of the Physics Colloquium series.

11. Should a student need to select a new thesis advisor, this selection must be made without delay.

12. Renewal of financial support from the department is contingent, each semester, upon satisfactory performance of teaching and other service duties and research activities, active participation in Department's events, and upon timely progress towards completion of all requirements for the Ph.D. degree.

Code	Title	Credit Hours
Required Courses		
PHY 621	Thermodynamics and Kinetic Theory	3
PHY 640	Classical Mechanics II (Thermodynamics and kinetic theory)	3
PHY 650	Electricity and Magnetism I (Intermediate electricity and magnetism I)	3
PHY 651	Electricity and Magnetism II (Intermediate electricity and magnetism II)	3
PHY 660	Quantum Mechanics and Modern Physics I	3
PHY 661	Quantum Mechanics and Modern Physics II	3
PHY 723	Statistical Mechanics I	3
PHY 752	Electromagnetic Theory I	3
PHY 770	Quantum Theory I	3
Four Additional Physics Courses at the 600 or 700 level (at least one at the 700 level)		12
PHY 840	Post-Candidacy Doctoral Dissertation	21
Total Credit Hours		60

Sample Plan of Study

Year One	Credit Hours
Fall	
PHY 640 Classical Mechanics II	3
PHY 660 Quantum Mechanics and Modern Physics I	3
PHY 650 Intermediate electricity and magnetism I	3
Credit Hours	9
Spring	
PHY 621 Thermodynamics and kinetic theory	3
PHY 661 Quantum Mechanics and Modern Physics II	3
PHY 651 Intermediate electricity and magnetism II	3
Credit Hours	9

Year Two		
Fall		
Physics 600-700 Level Elective		3
PHY 770	Quantum Theory I	3
PHY 780	Directed Readings or Research	3
Credit Hours		9
Spring		
PHY 723	Statistical Mechanics I	3
PHY 780	Directed Readings or Research	3
Physics 600-700 Level Elective		3
Credit Hours		9
Year Three		
Fall		
PHY 752	Electromagnetic Theory I	3
Physics 600-700 Level Elective		3
Credit Hours		6
Spring		
PHY 840	Post-Candidacy Doctoral Dissertation	3
Credit Hours		3
Fourth and Fifth Years		
PHY 616	Special Topics in Physics	3
PHY 840	Post-Candidacy Doctoral Dissertation	12
Credit Hours		15
Total Credit Hours		60

Mission

The mission of the Physics Ph.D program is to develop productive and creative research scientists and educators by providing students with a rigorous grounding in classical and modern theory, practice in advanced experimental techniques, training in a specialized field of research, and teaching experience.

Goals

It is expected that graduates will be capable of conducting independent research, solving complex problems, communicating scientific results in both written and spoken form, and critically assessing the scientific literature.

Student Learning Outcomes

- Students will demonstrate a rigorous grounding in classical and modern physics theory, the associated mathematical methods and their applications.
- Students will demonstrate their ability to conduct independent research, incorporating the ability to critically analyze and address a fundamental problem in their chosen field.
- Students will demonstrate the ability to communicate research findings effectively